No. XX.

STATICAL HYDRAULIC ENGINE.

The THANKS *of the Society were this session voted to Mr.* GEORGE MANWARING, *Engineer, Marsh-place, Lambeth, for presenting to the Society, and allowing them to publish, a description of his Statical Hydraulic Engine.*

IN the fifth volume of the Society's Transactions is a description, by the late Mr. Smeaton, of a statical hydraulic engine, invented by Mr. Wm. Westgarth, and rewarded by the Society in 1769. The attention of the Society being particularly directed last session to the working model of the above engine placed in their repository, the same was referred to the consideration of a committee.

At one of the meetings on this subject, it being stated that Mr. Manwaring had some years ago erected, near Whitby, an improved engine, on the principle of Mr. Westgarth's, it was recommended to the Society to make application to Mr. Manwaring to furnish them, at their expense, with a drawing or model of the engine so improved by him. With this request Mr. Manwaring very obligingly complied, by offering to the acceptance of the Society a drawing of his engine, and allowing them to insert a representation and description thereof in the next volume of the Transactions.

Description of a Statical Hydraulic Engine, erected by Mr. Manwaring, for Messrs. Cook and Co., at their Alum Works, near Whitby, in the year 1812.

In the common steam-engine the prime mover is a piston-rod, alternately rising and falling in a cylinder, in consequence of the elasticity of steam let into the cylinder, alternately above and below the piston.

In the statical hydraulic engine the prime mover is exactly the same as in the steam-engine; but the motion given to the piston-rod is by means of the statical pressure of a column of water, applied alternately above and below the piston.

In plate IX. is a representation of the engine. A is the pipe by which the supply of water is brought from a head, one hundred and seventy feet above the engine; B is a vessel containing air, the continual elastic pressure of which prevents the blow that would otherwise be occasioned by the descent of the water; C is a throttle valve; *d d* is a hollow open cylinder, working within an exterior one, and closely applied to that cylinder at the parts *e e*, *e e*, but elsewhere leaving a vacant space between the two cylinders for the reception of the water; *h h* are packings, in order to prevent the escape of the water between the two cylinders; and *i i* are adjusting screws, to tighten the packing in proportion as it is worn away: *f f* are two passages that lead into the upper and lower ends of the pipe *g*, in which the piston *w* works.

When the cylinder *d d* is in the position represented in the plate the communication is open, by means of the upper pipe *f*, for the water to flow into the pipe *g*, *above*

the piston *w*; at the same time the passage is open for the water in the cylinder *g*, *below* the piston, to flow out, through the lower pipe *f*, and through the lower part of the open cylinder *d*, into the pipe *x*, which is somewhat more than thirty feet long, and terminates in a cistern of water. There is, therefore, above the piston *w* a hydrostatic pressure, equal to one hundred and seventy feet of water, and below it a partial vacuum; the piston consequently descends to the bottom of the pipe *g*. By the time that it has arrived in this position the cylinder *d* will also have descended so far as to have opened the communication between the entering water and the lower pipe *f*, and to have shut off its communication with the upper pipe *f*; the hydrostatic pressure is therefore transferred to the under part of the piston, which consequently rises, while the water above the piston pours into the top of the cylinder *d*, and escapes through the pipe *x*.

The alternate motion of the slide or cylinder *d* is thus effected. The rod of the piston *w* is attached at its top to one end of the beam; at the other end of the beam is a rod, terminating below in the crank *m*: the oscillating motion of this crank is transferred, by means of the connecting bar *l*, to the axis *k*, on which is placed the curved tooth or cam *n*: this latter is inclosed within the rectangular frame (or cam-box) *j*, and being moveable in a horizontal position, is consequently made to perform a backward and forward motion, by the cam pressing first on one and then on the other side of the box. To the outside of the box are fixed two guide-bars, supported on the bearings *o o*: the connecting rod *p* is fastened at one end to the guide-bar, and at the other end to the arm *q* of a bent lever, having for its fulcrum the pivot *r*: the other

end of the lever is forked, and embraces the pipe *x*: one of these forks *s* is connected with the lower end of the upright rod *t*, and the other fork is connected with a similar rod. These rods are fastened at top to the two ends of a cross-bar, to the middle of which is fixed the rod *u*, which works in the stuffing-box *v*, and gives motion to the slide *d*.

The slide remains stationary nearly half a stroke of the piston, in order to allow the water to act with its full force; and this is effected by its being necessary for the cam, after it has moved the box in one direction, to perform about a quarter of a revolution before it can act on the opposite side of the box.

The reason for making the passages *ff* as large as represented is, to diminish as much as possible the friction of the water, which otherwise would retard the motion of the piston.